QUALITY ASSURANCE PROJECT PLAN

FOR

Phase II Environmental Site Assessment
Moran Generating Plant
Burlington, Vermont

March 2005

Prepared for:

City of Burlington
Community and Economic Development Office
Room 32, City Hall
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The following Exhibits are attached:

Form A: Title and Approval Page

Brownfield QAPP for Former Moran Generating Plant, Burlington, Vermont
Document Title

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March 8, 2005
Date

Project Manager: _____
Signature

_____
Printed Name/Date

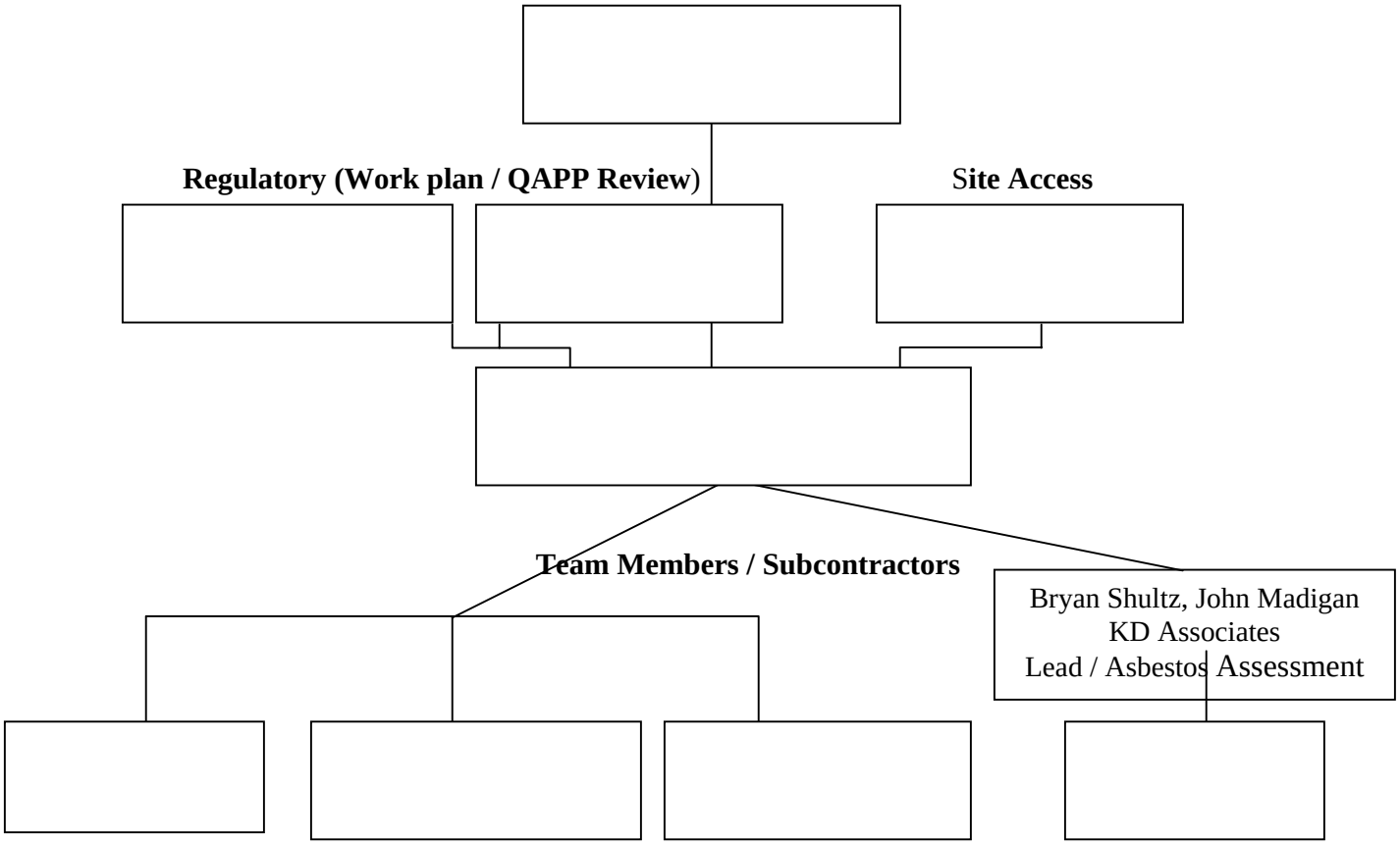
Project QA Officer: _____
Signature

_____
Printed Name/Date

U.S. EPA Project Manager Approval: _____
Signature

_____
Printed Name/Date

Form B: Project Organization and Responsibility



Form C: Problem Definition

The City of Burlington, Community and Economic Development Office (CEDO) is considering Brownfields Redevelopment of a property occupied by the former Moran Generating Plant ("Site"). The property is located at the end of Lake Street on the edge of Lake Champlain, as shown in **Figure 1** in **Exhibit 1**. The boundaries of the Site are shown in the **Figure 3** in **Exhibit 2**. The Site is on the southern margin of the 40-acre Urban Reserve.

The Moran Plant was operated by the Burlington Electric Department (BED) as a coal-burning power plant from 1953 to 1986. Electric transformers were abundant at the Plant, and records provided by the BED showed low concentrations of PCBs in the soil adjacent to several transformers in the 1980s. Since decommissioning of the Moran Plant in 1986, the building has generally remained vacant, with the exception of the Lake Champlain Community Sailing Center (LCCSC) occupation of a small area in the west end on the ground level.

During decommissioning of the Moran Plant in 1987, the vast majority of the asbestos containing materials (ACMs) were removed. Based on records provided to the State by the asbestos contractor, Eastern Refractories Company, Inc., a total of 236 bags of ACMs were removed from the "condenser", and 128 bags of ACMs were removed from the "deaerator tank". Upon removal, the final air clearance results ranged between 0.0013 and 0.0036 fibers per cubic centimeter.

Prior to 1953, this portion of Burlington was used for a wide range of industrial purposes, including railroad, lumber yard and mill, and storage/transportation of petroleum products. Petroleum tanks, ranging in size from 400,000 to 4,000,000 gallons, were abundant to the north of the Plant until the early 1990s.

In 1991, a limited subsurface investigation was conducted within the former coal storage area (see **Figure 2 & 3** in **Exhibit 2**) by Champlain Consulting Engineers. Based on soil screening results using a photo-ionization detector (PID), there was no indication of field-detectable volatile organic compounds (VOCs) in the soil. Groundwater sampling results from these wells were not available.

In 1999, a more comprehensive investigation was conducted in the area surrounding the Moran Plant as part of a Phase II ESA of the Urban Reserve conducted by Lamoureux & Dickinson. Within the current boundaries of the Moran Site, seven (7) hand auger borings, two (2) soil gas sampling points, one (1) borehole, and one (1) monitoring well were installed for soil screening, soil sampling, and groundwater sampling (refer to **Figure 3** in **Exhibit 2** for sampling locations). The results indicated that:

- VOCs were <u>not</u> detected by field screening using a PID in any of the seven hand auger borings (HA-30, 31, 32, 33, 34, 35, 36) or in borehole BH-19. In addition, VOCs were

not reported above detection limits in HA-34 or HA-35, which were submitted for laboratory analysis (EPA Method 8260B).

- PAHs were not reported above detection limits in HA-34 or HA-35, which were submitted for laboratory analysis (EPA Method 8270C).
- PCBs were not reported above detection limits in HA-34 or HA-35, which were submitted for laboratory analysis (EPA Method 8082).
- Of the 13 metals tested in HA-34 and HA-35 (Priority Pollutant Metals), elevated concentrations of arsenic, lead, and zinc were reported.
- Petroleum VOCs (benzene, toluene, ethylbenzene, xylenes, and total petroleum hydrocarbons) were not reported above detection limits in any of the three soil gas sampling locations (SG-19, SG-20, SG-21).
- The following VOCs were reported above detection limits in groundwater from monitoring well MW-14: 1,1 Dichloroethane (1,1DCA), cis-1,2 Dichloroethene (cis-1,2 DCE), Tetrachloroethene (PCE), Trichloroethene (TCE), and 1,1,1 Trichloroethane (1,1,1 TCA). Only the TCE concentration was above Vermont Groundwater Enforcement Standards (VGES).

The general conclusions of the Urban Reserve Phase II were that the levels of soil and groundwater contamination observed were lower than expected for this type of site. While some mitigation was deemed to be necessary for select portions of the Urban Reserve, no mitigative measures were recommended for the Moran Plant.

It should also be noted that environmental work has been conducted on the property immediately south of the Site, land now operated by the Burlington Electric Department for their gas turbine. Two (2) USTs were removed from this property in the early 1990s (2,000-gallon diesel and 3,000-gallon gasoline). After evidence of soil contamination was discovered during the tank pulls, the site became active (VT DEC Site #90-0540) and additional work was conducted. Groundwater sampling conducted in 1993 indicated that the effect of the petroleum releases was "minimal". No further work was required by the VT DEC.

In summary, the following have been identified for further investigation at this Site:

Potential Contaminant(s) of concern:

(1) Volatile organic compounds (VOCs):
(2) Polycyclic Aromatic Hydrocarbons (PAHs)
(3) Metals
(4) Polychlorinated Biphenyls (PCBs)
(5) Lead Paint
(6) Asbestos Containing Materials

Media Potentially Impacted:

(1) groundwater
(2) soil
(3) interior building space

Based upon review of the Site history and consideration of the proposed future use of the Site, questions to be addressed by this investigation include:

- What is the hydraulic flow direction and gradient of groundwater beneath the site?
- Is there shallow soil contamination with VOCs, PCBs, PAHs or metals in the area immediately surrounding the Moran Plant where future construction work may occur?
- Is there shallow soil contamination with VOCs, PCBs, PAHs or metals in the former coal storage area, where a proposed play area is to be located?
- Is there shallow soil contamination with VOCs, PCBs, PAHs or metals in the near the former bulk petroleum tank?
- Is there groundwater contamination with VOCs surrounding (hence underneath) the Moran Plant building, on the Site grounds, or near the southern, eastern, or northern Site boundaries?
- Is the source of low levels of chlorinated hydrocarbons previously reported in groundwater from an onsite or offsite source? If the source is onsite, is DNAPL a potential factor?
- Is there groundwater contamination with PCBs, PAHs or metals in the groundwater surrounding (hence underneath) the Moran Plant building or under the former coal storage area?
- Is there lead-based paint inside the Moran Plant building?
- Is there residual bulk material or dust containing ACMs inside the Moran Plant building?
- Do the potential contaminant concentrations in soil and groundwater present a significant risk to the environment or human health considering the proposed use of the property?
- Will the contaminant concentrations present restrictions to re-development of the property?

Form D: Project Description

The Data Quality Objectives (DQO) for this Phase II are designed to characterize soil and groundwater conditions on the grounds of the subject property, and to determine whether lead and/or asbestos containing materials are present inside the former Plant. Specific DQOs for the media to be tested are described below:

Soils DQO:

The soils DQO is to determine whether former on-site or off-site practices have contaminated the soil on the property with VOCs, PAHs, PCBs or metals. A total of five (5) soil samples will be collected during the soil boring process: three (3) samples will be collected from borings installed adjacent to the building, one (1) sample will be collected from the grounds within the former coal storage area where a children's play area is proposed, and one (1) sample will be collected near a former bulk petroleum storage tank. Samples for analysis of PAHs, PCBs, and metals will be collected from the near surface (0-1 ft); the samples for analysis of VOCs will be collected from the bottom of each boring at an anticipated interface with a dense layer to evaluate the potential for presence of DNAPL. Field techniques and laboratory results will undergo a modified Tier I validation. The sample results will be compared to the EPA Region IX Preliminary Remediation Goals (PRGs).

Groundwater DQO:

The groundwater DQO is to determine whether former on-site or off-site practices have contaminated the overburden groundwater under the Site with VOCs, PAHs, PCBs or metals. A secondary DQO is to determine the source of low levels of chlorinated VOCs that have previously been reported in an existing monitoring well on the Site. Groundwater samples will be collected from six (6) monitoring wells to be installed on the property. All six (6) wells will be sampled for VOCs. In addition, two (2) of the wells will be sampled for PAHs, PCBs and metals; one (1) sample will be collected from the well immediately upgradient of the Moran Plant, and one (1) sample will be collected from the well near the former coal storage area. One (1) duplicate sample will be collected for analysis of each analytical method used, and a trip blank and field blank will be collected for VOC analysis. Field techniques and laboratory results will undergo a modified Tier I validation. The sample results will be compared to the VGES and PRGs.

Interior Building DQO:

The interior building DQO is to determine whether lead paint or ACMs are present inside the building and/or in residual dust. Paint chip samples will be collected from primary surface coatings and analyzed by Flame AAS. After inspection to identify all interior and exterior suspected asbestos containing materials (ACMs), bulk samples and dust samples will be collected in accordance with Department of Health protocols and analyzed by Polarized Light Microscopy (PLM). It is estimated that 20-25 samples of each material will be collected.

The following specific tasks will be completed as part of the Phase II ESA conducted at the Moran Plant property in order to achieve the DQOs for this site.

Interior Lead & Asbestos Assessment

KD Associates will conduct lead and asbestos assessments within the Moran Plant. Paint chip samples will be collected from primary surface coatings and analyzed by Flame AAS. After inspection to identify all interior and exterior suspected asbestos containing materials (ACMs), bulk samples and dust samples will be collected in accordance with Department of Health protocols and analyzed by Polarized Light Microscopy (PLM). It is estimated that 20-25 samples of each material will be collected. Analysis will be by EMSL Analytical.

As per the EPA asbestos NESHAP regulations (National Emission Standard for Hazardous Air Pollutants US EPA 40 CFR part 61) and the Vermont Department of Health Regulations for Asbestos Control (V.S.A. Title 18, CH. 26), the assessment will be conducted by a certified asbestos inspector. This survey will attempt to find materials hidden from casual view. However, materials located above permanent ceilings, enclosed within walls or otherwise inaccessible may not be sampled.

Subsurface Investigation

To assess soil and groundwater quality underneath the building footprint, WEM will oversee the installation of six (6) soil borings/monitoring wells on the Site. Three (3) soil borings/monitoring will be installed at the very southern, eastern, and northern edges of the Moran Plant. To assess conditions at other strategic locations within the Site boundaries, three (3) additional borings will be installed. The approximate locations of these proposed borings, labeled as PMW-1 through PMW-6, are shown on **Figure 3** in **Exhibit 2**.

The borings will be installed using a Geoprobe (direct push) drill rig operated by Kennedy Drilling, LLC. The soil borings will be advanced approximately an estimated depth of 10 feet below grade (ft bg); the water table is estimated to be approximately 3-6 ft bg. Based on the soil boring logs from a previous investigation, the overburden soil is anticipated to be fine, loose, brown sand with layers of coal dust above a very dense olive gray sand at the depth of 8-10 ft bg. The monitoring wells will be completed with 1.0-in. diameter PVC, factory slotted, well screen from a depth of 3-10 ft bg, and finished with 1.0-in. diameter PVC riser pipe. The annulus between the well screen and the borehole will be filled with a sand pack to just above the well screen where it will be sealed with a bentonite plug. The wells will be finished with a flush mounted road box or stickup well guard. The wells will be installed in accordance with WEM protocols to state and industry standards.

Soil samples will be collected continuously within the Geoprobe sample tubes. Undisturbed soil samples will be screened for VOCs with a photoionization detector (PID) equipped with a 10.2 eV bulb, and then categorized as to soil type. In addition, five (5) of soil borings will be sampled for laboratory analysis of VOCs (EPA Method 8260B), PAHs (EPA Method

8270C), PCBs (EPA Method 8082), and Priority Pollutant Metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc). It is anticipated that three (3) of these samples will be collected from the borings to be installed directly outside the Plant, one (1) sample will be collected from boring where the coal storage area was formerly located, and one (1) sample will be collected from the boring near the former bulk petroleum storage tank. Samples for analysis of PAHs, PCBs, and metals will be collected from the near surface (0-1 ft); the samples for analysis of VOCs will be collected from the bottom of each boring at an anticipated interface with a dense layer to evaluate the potential for presence of DNAPL. The soil boring logs, monitoring well specifications, and laboratory analytical results will be included in the summary report.

These six soil borings/monitoring wells are estimated to be completed in the period of one day. Note that if significant debris and stone fill is encountered in the subsurface, the drilling program may need to be extended into a second day.

Site Survey

Upon completion of the drilling program, the newly installed monitoring wells will surveyed by WEM. The survey will locate each well in azimuth and elevation, relative to a Site benchmark. The survey will also include features (building corners, utility lines, etc.) necessary to develop an accurate Site Map.

Groundwater Monitoring

Prior to groundwater sample collection, depth to groundwater will be measured in each of the new wells at the Site. These data will be used to calculate the water level elevations and to determine the groundwater flow direction and horizontal and vertical gradients beneath the Site.

Groundwater samples will be collected from the newly installed monitoring wells by WEM using a peristaltic pump and dedicated polyethylene and silicon tubing. Wells will be purged at a rate of 300-600 ml/min to achieve a minimum of three well volumes or until dry. WEM has corresponded with the EPA[1] and confirmed that this sampling protocol is acceptable for this Brownfield project. All samples will be collected in accordance with WEM protocols for sampling. All purgewater will be discharged to the ground surface.

All six (6) of the groundwater samples will be analyzed for VOCs (EPA Method 8260B). In addition, two (2) of the wells will be sampled for PAHs (EPA Method 8270C), PCBs (EPA Method 8082), and Priority Pollutant Metals. In accordance with the quality assurance program, a duplicate sample, trip blank, and field blank will also be collected and analyzed. Samples will be submitted for analysis to Endyne, Inc., of Williston, Vermont.

[1] Telephone conversation with Alan Peterson, EPA, February 2, 2005.

Data Validation

Following receipt of laboratory analytical data and laboratory quality assurance information, the laboratory analytical results will be verified by the QA Officer. The verification process will be a modified Tier I completeness review to ensure that the precision is consistent with SW-846 Guidelines. The QA Officer will verify that the required documents and forms are present in the data package from the laboratory, initiate requests for missing documentation, and evaluate the results of any performance evaluation (PE) samples reported QC parameters in the analyses. A brief report will be produced describing the contents of the data package and summarizing the degree of compliance with expectations. The validation report will be included with the Phase II ESA report as an appendix.

Data Analysis / Summary Report

A summary report will be prepared for submittal within two weeks of the receipt of the data validation report. The summary report will include: a site map; a groundwater contour map; contamination distribution information; groundwater and soil analytical data; discussion of the data validation report; soil boring log and monitoring well construction diagrams; conclusions; and recommendations. The recommendations will address details and estimated costs of any additional environmental work that is necessary for the Site.

Public Meeting Attendance

WEM will attend two public meetings to provide interpretation of the investigation results, conclusions, and recommendations.

Project Timeline

Task / Week	February 18, 2005	February 21, 2005	February 28, 2005	March 7, 2005	March 14, 2005	March 21, 2005	March 28, 2005	April 4, 2005	April 11, 2005	April 18, 2005	April 25, 2005	May 2, 2005	May 9, 2005
Contract Signing													
Work Plan to CEDO													
Work Plan to DEC													
Work Plan Review/Approval DEC													
QAPP Preparation													
QAPP Review/Approval by EPA													
Premark Drilling Locations													
Lead/Asbestos Assessment													
Soil Borings/Monitoring Well Install													
Groundwater Sampling													
Laboratory Sample Analysis													
Data Validation													
Report Preparation & Submission													
Public Meetings													

Form E: Sampling Design

The proposed monitoring wells/soil borings are summarized in **Table 1** in **Exhibit 2**. The sample locations are presented in **Figure 3** in **Exhibit 2**.

Shallow Soil Sampling

Contaminant(s) of concern: **VOCs, PAHs, PCBs, and metals**

Six (6) soil borings/monitoring wells will be advanced on the property. The approximate locations are indicated on the **Figure 3** in **Exhibit 2**. During borehole advancement, continuous samples will be collected in 4-ft intervals to a depth of 10 feet below grade. Soil samples will be screened for headspace in accordance with the attached standard operating procedure using a photoionization detector (PID). Additionally, each soil sample will be visually inspected for staining, unusual odors, and the identification of fill materials. A total of five (5) soil samples will be submitted for laboratory analysis: three (3) samples will be collected from borings installed adjacent to the building, one (1) sample will be collected from the grounds within the former coal storage area, and one (1) sample will be collected from near the former bulk petroleum tank at the northern margin of the Site. Each of the five soil samples will be submitted for laboratory analysis of VOCs by EPA 8260B, PCBs by EPA Method 8082, PAHs by EPA Method 8270C and Priority Pollutant (PP) metals. The results of the laboratory analysis will be compared to the PRGs.

Rationale:

The soil sampling strategy is based on the assumptions that shallow soil contamination may be present in the soil immediately surrounding or underneath the building and/or within the former coal and bulk petroleum storage areas as a result of petroleum spills/releases, transformer oil, solvent/degreaser use, or residual contaminants from storage and combustion of coal. Because low levels of chlorinated VOCs have been reported in a former groundwater monitoring well, a potential DNAPL source will be evaluated by sampling the soil from the bottom of each boring, at the interface with an anticipated dense sandy layer. Samples for the other contaminants of concern will be collected from the near surface (0-1 ft) soil.

EPA Methods 8082 for PCBs, 8270C for PAHs, and Methods 6010, 7470 and Standard Method 3113B for PP metals are appropriate analytical techniques for the quantification of the identified contaminants of concern. The anticipated quantitation limits for each of these analyses are below the applicable PRGs based upon the reporting limits presented by Endyne.

Interior Building Material Testing

Contaminant of Concern: **Asbestos**

Bulk samples of all accessible suspect asbestos containing materials will be collected inside the Moran Plant by a Vermont Department of Health certified Asbestos Inspector. As required in the Vermont Department of Health, Asbestos Control Division protocols, multiple samples of each material will be collected and analysed by polarized light microscopy (PLM), EPA Method 600/R-93/116 until a positive sample is found or all samples are analysed. A material will be considered positive for asbestos if one sample is found to contain greater that one percent asbestos. The number of samples collected shall be determined in accordance with protocols described in the Environmental Protection Agency (40 CFR part 763) Asbestos-Containing Materials in Schools; Final Rule and Notice. Additionally, samples of all surfacing materials will be collected in a statistically random fashion according to the EPA document Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials as applicable.

Rationale:

The asbestos sampling strategy is based upon a walk-through of the site, documentation of previous sampling and asbestos abatement at this site provided by the City, and experience performing asbestos assessments in similar industrial settings. Polarized Light Microscopy (PLM) is the appropriate and most economical analytical technique for the analysis of asbestos in building materials expected in this setting and is acceptable to the Environmental Protection Agency as well as the Vermont Department of Health in determining the presence of asbestos.

Contaminant of Concern: **Lead in Paint**

A limited assessment of the former Moran Plant for the presence of lead containing paint will be performed. An on-site inspection to identify and collect paint chip samples representative of the primary surface coatings will be performed by a Vermont Department of Health certified Lead Inspector. This screening is not intended to be a comprehensive testing of all surfaces and building components, but rather an indication of what is representative of lead in surface coatings. Samples will be analysed by Flame AAS (SW 856, 7420).

Rationale:

The lead assessment and sampling strategy is based upon a walk-through of the site and experience performing lead assessments in similar industrial settings. Analysis of paint chip samples by Flame AAS provides a low analytical limit of detection appropriate for an industrial setting and in anticipation of Occupational Safety and Health rules as they may apply to the renovation of this site.

Groundwater Sampling

Contaminant(s) of concern: **VOCs, PAHs, PCBs, and metals**

Each of the six newly installed groundwater monitoring wells will be sampled according to WEM's Monitoring Well Sampling (Peristaltic Pump) Protocol. Three well volumes will be evacuated from each well prior to sampling. All six (6) wells will be sampled for VOCs. In addition, two (2) of the wells will be sampled for PAHs, PCBs and PP metals; one (1) sample will be collected from the well immediately upgradient of the Moran Plant, and one (1) sample will be collected from the well near the former coal storage area. One (1) duplicate sample will be collected for analysis of each analytical method used, and a trip blank and field blank will be collected for VOC analysis. Field techniques and laboratory results will undergo a modified Tier I validation. The sample results will be compared to the VGES.

Rationale:

The groundwater sampling strategy is based on the assumptions that overburden groundwater contamination may be present underneath the building and/or under the Site as result of petroleum spills/releases, transformer oil, solvent/degreaser use, or residual contaminants from storage and combustion of coal. Low levels of chlorinated VOC contamination have been confirmed in a formerly installed monitoring well on the north side of the building. Offsite sources of VOC contamination include the former petroleum USTs to the south of the Site and Petroleum ASTs to the north of the Site.

EPA Methods 8260B for VOCs, 8082 for PCBs, 8270C for PAHs, and Methods 6010, 7470 and Standard Method 3113B for PP metals are appropriate analytical techniques for the quantification of the identified contaminants of concern. The anticipated quantitation limits for each of these analyses are below the applicable VGES and PRGs based upon the reporting limits presented by Endyne.

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Form F-1: Method and SOP Reference Table

Analytical Method Reference:	**Project Analytical SOPs:**
1a. SW-846 Method 8270; Rev. 2; 9/94 Semi-Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS): Capillary Column Techniques.	1b. Semi-Volatile Organic Contaminants Method EPA 8270C Standard Operating Procedure, February 21, 2003, Revision #6, Endyne, Inc.
2a. SW-846 Method 8260; Rev. 1; 9/94 Measurement of purgeable organic compounds in water/soil by capillary column gas chromatograph/mass spectrometry.	2b. Volatile Organic Compounds Method 8260/8260B Standard Operating Procedure; January 26, 2004, Revision #7, Endyne, Inc.
3a. SW-846 Method 3010; Rev 1; 7/92 Acid digestion of Aqueous Samples and extracts for Total metals for Analysis by FLAA or ICP Spectroscopy.	3b. ICP Standard Operating Procedure, EPA Method 6010B, October 14, 2004, Revision #2, Endyne, Inc.
4a. EPA Method 245.1, Mercury by Cold Vapor AA Spectrometry –Manual. / EPA Method 7470 Manual Cold Vapor Technique	4b. Mercury in Solid or Semisolid Waste, Method SW 7471, October 14, 2004, revision #3, Endyne, Inc.
5a. Standard Methods for the Examination of Water and Wastewater Method 3113, AWWA, 1998.	5b. Atomic Absorption Spectrometry Method SM 3113B Standard Operating Procedure, October 14, 2004, revision #7, Endyne, Inc.
6a. SW-846 Method 8082: Rev 1: 9/94 Measurement of polychlorinated biphenyls in water/soil by capillary column gas chromatograph/mass spectrometry.	6b. Polychlorinated Biphenyls (PCBs) Method EPA 8082 Standard Operating Procedure; February 19, 2004, revision #8, Endyne, Inc.
7a. SW-856 Method 7420, Flame AAS	
8a. EPA Method 600/R-93/116, Polarized Light Microscopy	

*see **Exhibit 4** for copies of Analytical SOPs

Form F-1 (continued)

Project Sampling SOPs:**
1c. WEM Protocol #1, Soil Screening, 12/03
2c. WEM Protocol #2, Soil Boring Installation 12/03
3c. WEM Protocol #3, Monitoring Well Installation, 12/03
4c. WEM Protocol #4, Water Level Measurement, 12/03
5c. WEM Protocol #5, Monitoring Well Sampling (Bailer), 03/05
6c. WEM Protocol #6, Surface Water Sampling, 12/03
7c. WEM Protocol #7, Seepage Sampling, 12/03
8c. WEM Protocol #8, Sample Handling, 12/03
9c. WEM Protocol #9, Soil/Sediment Sampling, 12/03
10c. WEM Protocol #10, Monitoring Well Sampling (Peristaltic Pump), 03/05

** See **Exhibit 3** for copies of referenced SOPs.

Form F-2: Sampling and Analytical Methods Requirements

Parameter	Matrix	Number of Samples (include field QC)	Analytical Method	Sampling SOP	Containers per Sample (number, size and type)	Preservation Requirements (temperature, chemical	Maximum Holding Time (to extraction)	Lab Holding Time (after extraction)
VOCs	Soil	5	2b	2c, 8c, 9c	2 40 ml glass; Teflon cap	Cool 4° C 1 methanol, 1 no preserve	14 days	40 days
PAHs	Soil	5	1b	2c, 8c, 9c	2 4 oz. glass	Cool 4° C	14 days	40 days
PCBs	Soil	5	6b	2c, 8c, 9c		Cool 4° C	14 days	40 days
PP Metals	Soil	5	3b, 4b, 5b	2c, 8c, 9c		Cool 4° C	28 days (Hg); 6 mos. (other)	40 days
VOCs	Water	6 1 trip blank 1 field blank 1 duplicate	2b	4c, 5c, 8c, 10c	2 40 ml glass; Teflon cap	Cool 4° C HCl to pH<2	14 days	40 days
PAHs	Water	2 1 duplicate	1b	4c, 5c, 8c, 10c	2 1L Amber glass	Cool 4° C	7 days	
PCBs	Water	2 1 duplicate	6b	4c, 5c, 8c, 10c	2 1L Amber glass	Cool 4° C	7 days	40 days
PP Metals	Water	2 1 duplicate	3b, 4b, 5b	4c, 5c, 8c, 10c	1 500 ml plastic	Cool 4° C HNO_3 to pH<2	28 days (Hg); 6 mos. (other)	40 days
Lead	Paint Chip	20-25	7a					
ACMs	Bulk Sample	20-25	8a					

Form G: Preventive Maintenance – Field Equipment

Instrument	Activity	Frequency
HNU PID	Check battery	Before each use
HNU PID	Cleaning the lamp	As needed based on calibration span data or field observations.

Form H: Calibration and Corrective Action – Field Equipment

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action
PID	Calibration	Beginning of the day	Calibration check	Initiate trouble shooting sequence
PID	Calibration Check	Before each use	± 10%	Recalibrate

Form I: Preventive Maintenance – Laboratory Equipment

The following acronyms are utilized in Form I and J:
GC: Gas Chromatograph
MS: Mass Spectrometer
AAS: Atomic Absorption Spectrophotometer
PID: Photo-ionization detector
FID: Flame ionization detector
ICP: Inductively coupled plasma
ECD: Electron Capture Detector
See Endyne Quality Systems Manual (Exhibit 5) for a listing of Equipment Brands and Model Numbers.

Instrument	Activity	Frequency	SOP Ref.
GC	Injection port septa changed	Every 20 injections	1b, 2b
GC/MS	HP service technicians service instrument, vacuum pump and diffusion pump	Annually	1b
GC	Injection port changed	If response varies.	1b, 2b
MS	Clean MS source	Poor response or failed tune criteria.	2b
MS	Replace MS filament	No sample response	2b
GC/MS	Air and water leak check	Following any instrumental maintenance and if high baseline or poor instrument response.	2b
GC purge and trap system Tekmar LCS-2	Replace the Vocarb 4000	If varying surrogate and analyte response or excessive analyte carry over.	2b
ICP	Replace / acid wash nebulizer	If <10,000 response observed	3b

Instrument	Activity	Frequency	SOP Ref.
		when peaking the X and Y axis.	
ICP	Acid rinse pump lines	Daily	3b
AAS	Replace sample and reagent tube	Monthly or if discolor	4b
AAS	Gas leak check	Quarterly	4b
AAS	Check hoses and connections	Daily	5b
AAS	Check exhaust system	Daily	5b
AAS	Clean instrument	Daily	5b
AAS	Check condition of graphite tube and platform	Daily	5b
AAS	Clean quartz furnace windows	Weekly	5b
AAS	Check condition of graphite electrodes	Quarterly	5b
AAS	PM Check by service engineer	Annually	5b
AAS	Check condition of graphite shroud	Annually	5b
GC	Replace Merlin Micro Seal Traditional septa	2000 Injections 30 Injections	6b
GC	Replace injection port liner	100-150 injections, when standard degradation is evident	6b
GC	Replace injection port orange O-rings	When dried and cracking	6b
GC	Replace column ferrules	When cutting the column	6b
GC	Injection port liner cleaning	As needed	6b

Form J: Calibration and Corrective Action – Laboratory Equipment

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref.
GC/MS 8270C	Initial calibration (11 point line)	At beginning of use or as needed	RF for the SPCC is >=0.050. RSD<15%; RT within 0.06 RRT units.	System maintenance or recalibration and reanalysis	1b
GC/MS 8270C	Calibration check: DFTPP Standard	Daily	Ion abundances for DFTPP within acceptable limits. DDT degradation byproducts less than 20% DDT peak area.	Recalibration	1b
GC/MS 8270C	Calibration check: 8270C Line Standard	Daily	Minimum RF 0.050 Percent difference from the RSD for each target analyte less than 20%,	Recalibration	1b
GC/MS 8260	Initial calibration (7 standard concentrations)	At beginning of use or as needed	Symmetrical peaks, minimal tailing 99% computer recognition RSD<20%	System maintenance or recalibration and reanalysis	2b
GC/MS 8260	BFB check	Every data set	BFB tune criteria	Recalibration	2b
GC/MS 8260	Calibration check	Every data set	RSD <20%, <30% drift since last calibration check, <50% drift since initial calibration	Recalibration	2b
GC/MS 8260	SPCC and CCC line check	Daily	within set limits	Recalibration	2b
ICP	Calibration	Monthly	%RSD<10 linearity, r +/- 0.999	System maintenance or recalibration and reanalysis	3b

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref.
AAS 245.1	Calibration check	Start; every tenth sample, end	+/- 15%	Recalibration	4b
AAS 3113B	Calibration	Daily	Variation <10%	System maintenance or recalibration and reanalysis	5b
GC/ECD	Calibration (minimum 3 standards)	As needed	Linearity, minimum correlation = 0.995. Line must pass through origin.	System maintenance or recalibration and reanalysis	6b

Form K: Sample Handling and Custody Requirements

This protocol details the procedures for sample container handling, following collection in the field.

Groundwater and Soil Samples

1. Upon sample collection, each sample container is affixed with an identification label that contains the following information, at a minimum:

- project name & number
- sample identification
- date and time sampled
- analysis required
- preservation used, if required
- sampler's name (initials)

Sample containers will be labeled, using an indelible ink marker, with sample identification, date, and time at the time a sample is actually collected to prevent accidental mix-up of samples that may occur when containers are pre-labeled prior to a sampling event. Other information (project name and number, analysis type, preservation type, and sampler's name) may be completed on the sample label prior to sample collection.

2. All samples (except lead and asbestos) are to be placed on ice or refrigerated immediately upon their collection. Samples will remain on ice or under refrigeration until they are delivered to the laboratory.

3. A Chain of Custody form is to be filled out as the samples are collected. Samples are entered onto the form in the order in which they are collected. All data recorded on the sample container label is copied onto the Chain of Custody form. Obvious contamination observed in the sampled material is noted on the Chain of Custody form. A copy of the Chain of Custody form should be maintained for project files.

4. All samples will be delivered to the laboratory within 48 hours (72 hours if a weekend or holiday interferes) of their collection, unless the analytical method requires a more rapid turn-round time, thus necessitating more rapid delivery.

A chain-of-custody form is enclosed as **Exhibit 6**.

Form L: Analytical Precision and Accuracy

Analyte	Analytical Method	Method Detection Limit (ppb)	Reporting Limit (ppb)	Precision (%) Diff.	Accuracy Limit (%)
PAHs (Water)	1b	0.244-1.07	2	20	57.6-127
PAHs (Soil)	1b	8.73-33.1	66.7	20	51.5-144
VOCs (Water)	2b	0.079-2.19	1-20	20	63.7-135
VOCs (Soil)	2b	0.844-3.94	10-200	20	63.4-135
PCBs (Water)	6b	0.1689	0.500	20	81.8-123
PCBs (Soil)	6b	6.93	25	20	81.8-123
Arsenic (Water)	3b	0.57	2	20	85-115
Antimony (Water)	5b	0.82	2	20	85-115
Beryllium (Water)	3b	0.3	2	20	85-115
Cadmium (Water)	3b	0.4	3	20	85-115
Chromium (Water)	3b	4.4	10	20	85-115
Copper (Water)	3b	2.43	10	20	85-115
Lead (Water)	5b	0.26	2	20	85-115
Mercury (Water)	4b	0.22	1	20	85-115
Nickel (Water)	3b	5.17	20	20	85-115
Selenium (Water)	5b	1.73	5	20	85-115
Silver (Water)	3b	4.53	10	20	85-115
Thallium (Water)	5b	0.36	1	20	85-115
Zinc (Water)	3b	2.16	20	20	85-115
Arsenic (Soil)	3b		2500	20	15
Antimony (Soil)	5b		1000	20	15
Beryllium (Soil)	3b		2500	20	15
Cadmium (Soil)	3b		1750	20	15
Chromium (Soil)	3b		1000	20	15
Copper (Soil)	3b		1000	20	15
Lead (Soil)	5b		1000	20	15
Mercury (Soil)	4b		300	20	15
Nickel (Soil)	3b		2500	20	15
Selenium (Soil)	5b		2500	20	15
Silver (Soil)	3b		2500	20	15
Thallium (Soil)	5b		500	20	15
Zinc (Soil)	3b		1000	20	15

Notes: Blank spaces indicate that data was not available from laboratory at time of QAPP preparation.
All soil reporting limits are based on clean matrix samples having a percent solid of 100%.

Form M: Field Quality Control Requirements

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Duplicate	5% VOC samples.	≤50% RPD	Repeat, if still out qualify results due to matrix interference.
VOA Trip Blank	1 per cooler	<QL	Depending on the amount of contamination, result will be qualified or rejected.
VOA Field Blank	1 per cooler	<QL	Depending on the amount of contamination, result will be qualified or rejected.
Bottle Blank	Bottles pre-washed with certificate of analysis included, so bottle blank shall not be performed	N/A	N/A

All sampling equipment will be disposable, dedicated equipment. Therefore, no equipment or rinsate blanks shall be performed.

Table M (Continued): Laboratory Quality Control Requirements

QC Sample	Frequency	Acceptance Criteria	Corrective Action
VOA Reagent / Method Blank	Daily	<DL	Depending on the amount of contamination, results will be qualified or rejected.
Laboratory Reagent Blank	5% per parameter per matrix	<DL	Depending on the amount of contamination, results will be qualified or rejected.
Laboratory Fortified Blank	5% per parameter per matrix	<DL	Depending on the amount of contamination, results will be qualified or rejected.
Matrix Duplicate	5% per parameter per matrix	≤50% RPD	Repeat, if still out qualify results due to matrix interference.
Matrix Spike	5% per parameter per matrix	≤50% RPD	Repeat, if still out qualify results due to matrix interference.

Form N: Data Management and Documentation

A permanently bound notebook with individually numbered pages and/or a pre-printed data sheet shall be used for field sampling. All entries are made with permanent ink, and corrections are made using a single line through the mistake with the initials and date of the individual who made them. Entries include persons present, sampling location, time/date, weather conditions, and any problem encountered during sampling.

The following deliverables will be provided by the laboratory:

-surrogate recoveries and acceptance limits
-matrix spike/matrix spike duplicate results and acceptance limits
-duplicate sample results
-Method/Reagent blank results
-Calibration standards/Reference standards/LBF reports

A summary or narrative of any deviation from the QC criteria as well as observations about the samples (i.e., missed holding times, trip blank contamination, and reference standards to check standards outside criteria).

The following deliverables will not be required, but will be maintained by the laboratory and may be requested at a later date:

-All raw data including chromatograms
-Copies of Instrument logbooks
-Copies of internal chains of custody

All reports are generated in hard copy form.

Form O: Assessment and Response Actions

Any deficiencies or problems encountered during this investigation require corrective action. The project QA Officer will be notified immediately if any problems are encountered in the field. Minor adjustments to the sampling design may proceed with notification of the project QA Officer and documentation in the field notebook. Major corrective action, such as encountering buried drums, require immediate notification of the EPA project manager prior to proceeding with the field investigation.

The laboratory must maintain its certification with the state of Vermont throughout the course of the project and must comply with applicable EPA regulations and guidelines.

The project manager and project QA officer will be responsible for identifying and reporting any deficiencies or problems. Any problems or deficiencies reported by telephone or in person to the QA officer will be documented on a telephone/personal conversation report form. Any problems or deficiencies reported in the field will be documented in the field notebook. Any corrective actions required will be documented in the field notebook.

Form P: Project Reports

Upon receipt of the laboratory data, a bound report will be prepared that includes the specific sample locations, field observations, detailed drilling/monitor well construction logs, laboratory data summary tables, a groundwater elevation contour map, and conclusions relating to soil and groundwater quality on site and lead and asbestos conditions inside the building.

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Form Q-1: Verification of Sampling Procedures

The sampling procedures will be recorded in the field on the designated field data sheets, and/or field notebook. The field data sheet will be reviewed to ensure the following information is properly documented:

Sample identification;
Source;
Date and time of sampling;
Sampling equipment;
Sampler(s); and
Results of any field monitoring or observations.

The sample handling procedures for each sample will be recorded on the chain-of-custody form. The chain-of-custody form will be reviewed to ensure the following information is properly documented:

Sample identification;
Number, type and size of sample containers;
Preservatives used; and
Signatures.

The review will be performed by the QA officer.

Form Q-2: Data Verification and Validation

The laboratory analytical results will be verified by the QA Officer. The verification process will be a modified Tier I completeness review to ensure that the precision is consistent with SW-846 Guidelines. The QA Officer will verify that the required documents and forms are present in the data package from the laboratory, initiate requests for missing documentation, and evaluate the results of any performance evaluation (PE) samples reported QC parameters in the analyses. A brief report will be produced describing the contents of the data package and summarizing the degree of compliance with expectations.

The results of the QA/QC samples to be reviewed include:

Laboratory method blank samples;
Surrogate recoveries;
Spiked samples;
Replicate samples; and,
Calibration samples.

Results of the duplicate, field blank and trip blank samples will be reviewed by the QA officer to verify accuracy of the analytical data. The duplicate sample results will be compared to the original sample results to ensure accuracy and repeatability of the data and sampling methodology. The field blank sample results will be used to verify that proper decontamination methods were used in the field. The trip blank sample results will be used to verify that the samples did not encounter contamination during transit to the laboratory.

Form R: Data Usability

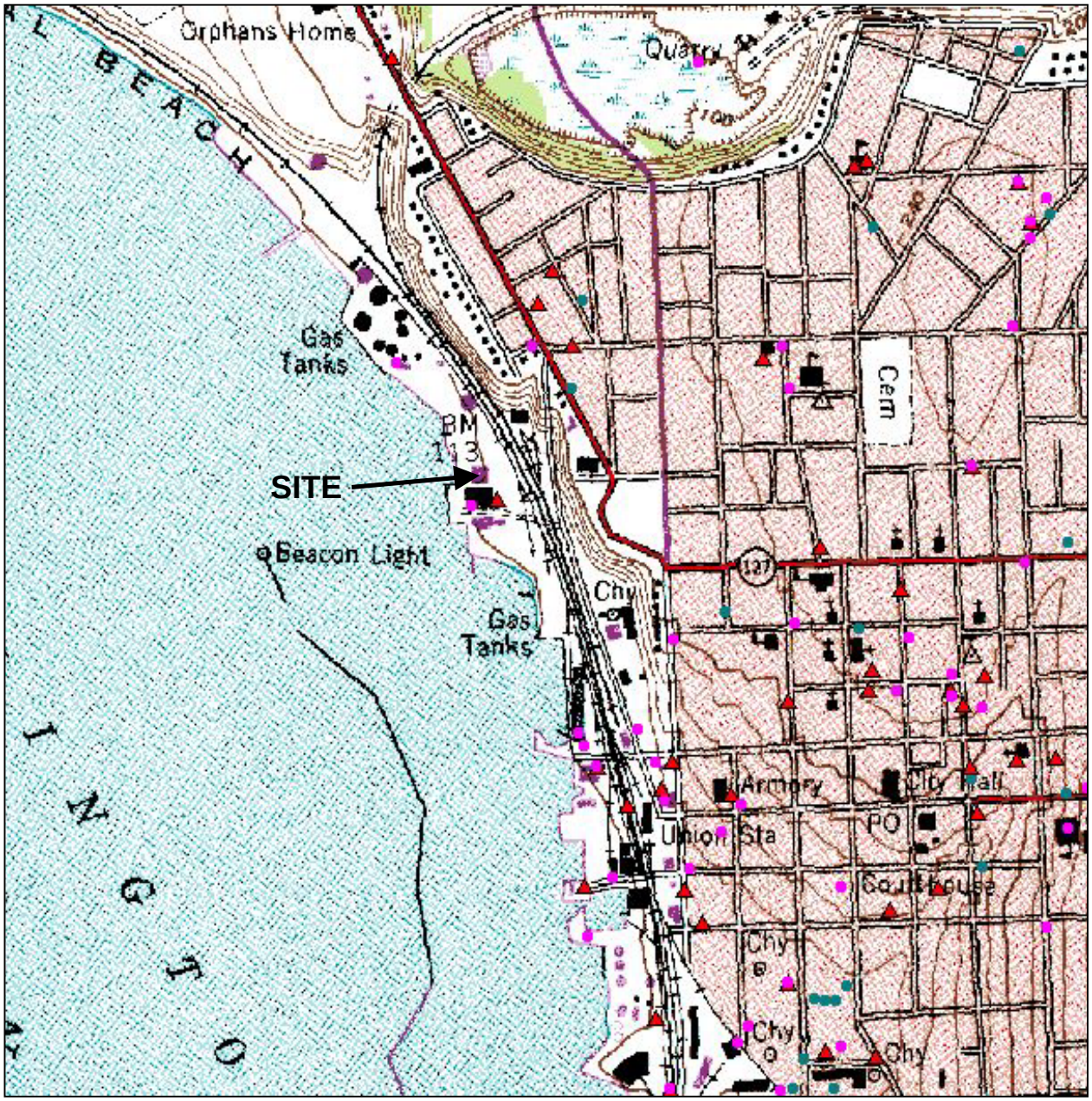
Evaluation of data usability will be based on a review of the data verification and DQO.

Assessment of the reported minimum detection levels (MDLs) in relation to established cleanup criteria will be performed. The matrix and/or interference may require a dilution, which increases the reported MDLs. The reported MDLs will be evaluated to determine that all concentrations above the cleanup criteria are reported. If the MDL exceeds the cleanup criterion, then the concentration will be assumed to exceed the cleanup criteria unless otherwise documented.

Results of the data usability assessment will be discussed in the final report. If the data are deemed to be useable, soil and groundwater results will be evaluated relative to the Vermont Groundwater Enforcement Standards (VGES) and the EPA Region IX Preliminary Remediation Goals (PRGs). If the data usability is limited, the limitations will be discussed in the report.

EXHIBIT 1

Figure 1 – Site Location Map



LEGEND

- State-Listed Hazardous Waste Site
- Registered UST
- Registered Hazardous Waste Generator

N

WEM Job Number:

Map Source: *USGS Mapping 7.5 Minute Burlington, Vermont Quadrangle (1987)*

Data Source *ANR databases, updated October 2003*

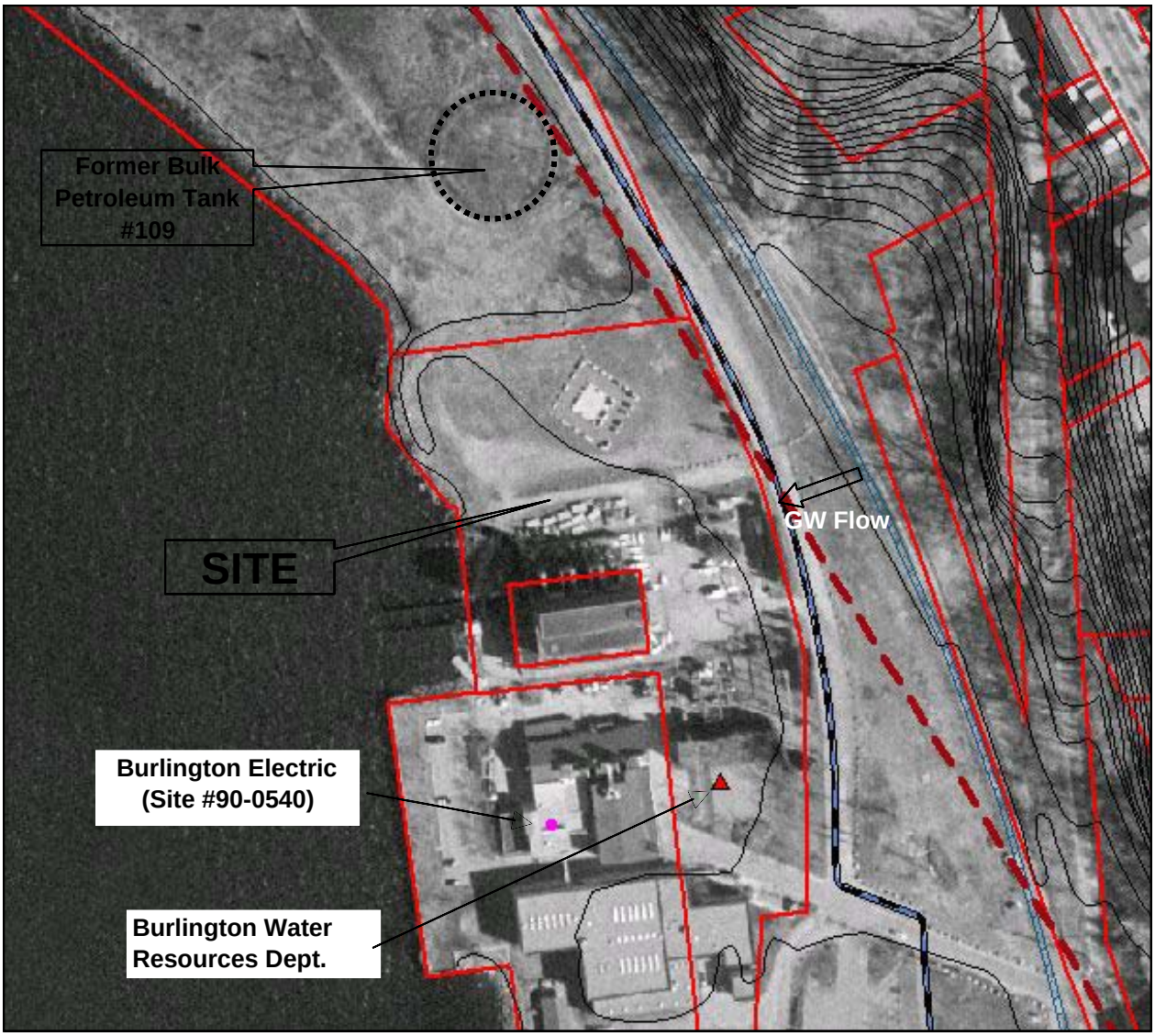
Waite Environmental Management, LLC

FIGURE 1
SITE LOCATION MAP
Moran Generating Plant
Burlington, VT

Date: 02/02/05	Drawing No. 1	Scale: 1" = 1,200	By: MEW

EXHIBIT 2

Figure 2 – Site Features Map
Figure 3 – Sampling Location Map
Table 1 – Soil Boring / Monitoring Well Placement and Sampling Rationale



LEGEND

- State-Listed Hazardous Waste Site
- Registered UST
- Limits of Fill
- Bike Path
- Rail Line
- Burlington Parcels (updated 2000)
- 5-Foot Elevation Contour

N

WEM Job Number:

Map Source: *Vermont Mapping Program, 1999 flight (file 92220)*

Data Sources: *ANR databases (10/03); City of Burlington Planning & Zoning*

WEM

Waite Environmental Management, LLC

FIGURE 2
SITE FEATURES MAP
Moran Generating Plant
Burlington, VT

Date: 02/02/05	Drawing No. 2	1" = 200'	By: MEW

LEGEND

Study Area Boundary

PMW Proposed Soil Boring / Monitoring Well

Existing Sampling Point: hand auger soil (HA), borehole soil (BH), groundwater monitoring well (MW), soil gas (SG)

Map Source: *Vermont Mapping Program, 1999 flight (file 92220); study area boundary from map provided by CEDO*

Note: *Existing sampling locations from Lamoureux & Dickinson, 2000; all locations approximate*

Waite Environmental Management, LLC

FIGURE 3
SAMPLING LOCATIONS
Moran Generating Plant
Burlington, VT

Date: 02/02/05	Drawing No. 3	1" = 100'	By: MEW

EXHIBIT 2
Table 1
Moran Plant Phase II ESA
Soil Boring / Monitoring Well Placement and Sampling Rationale

Source Target	Location	Proposed Monitoring Well No.	Groundwater Laboratory Analysis	Soil Laboratory Analysis
Onsite Leaks / Spills / Residual Contaminants Offsite Petroleum Sources To South (B.E.D) Northward Migration Underneath Building	Adjacent To Moran Plant	PMW-1	VOCs 8260B	VOCs 8260b (deep) PAHs 8270C (shallow) PCBs 8082 (shallow) PP Metals (shallow)
Onsite Leaks / Spills / Residual Contaminants Westward Migration Underneath Building	Adjacent To Moran Plant	PMW-2	VOCs 8260B PAHs 8270C PCBs 8082 PP Metals	VOCs 8260b (deep) PAHs 8270C (shallow) PCBs 8082 (shallow) PP Metals (shallow)
Onsite Leaks / Spills / Residual Contaminants Southward Migration Underneath Building	Adjacent To Moran Plant	PMW-3	VOCs 8260B	VOCs 8260b (deep) PAHs 8270C (shallow) PCBs 8082 (shallow) PP Metals (shallow)
Onsite Leaks / Spills / Residual Contaminants Westward Migration From Offsite	Access Road At SE Corner	PMW-4	VOCs 8260B	
Coal Storage Residual Contaminants Westward Migration From Offsite	Former Coal Storage Area	PMW-5	VOCs 8260B PAHs 8270C PCBs 8082 PP Metals	VOCs 8260b (deep) PAHs 8270C (shallow) PCBs 8082 (shallow) PP Metals (shallow)
Leaks / Spills From Former Bulk Petroleum Tank Southward Migration From Offsite	Former Petroleum Tank Area	PMW-6	VOCs 8260B	VOCs 8260b (deep) PAHs 8270C (shallow) PCBs 8082 (shallow) PP Metals (shallow)

EXHIBIT 3

WEM Standard Operating Procedures

EXHIBIT 4

Endyne Laboratory Standard Operating Procedures

EXHIBIT 5

Endyne Laboratory QA Manual

EXHIBIT 6

Endyne Laboratory Chain –of-Custody Form